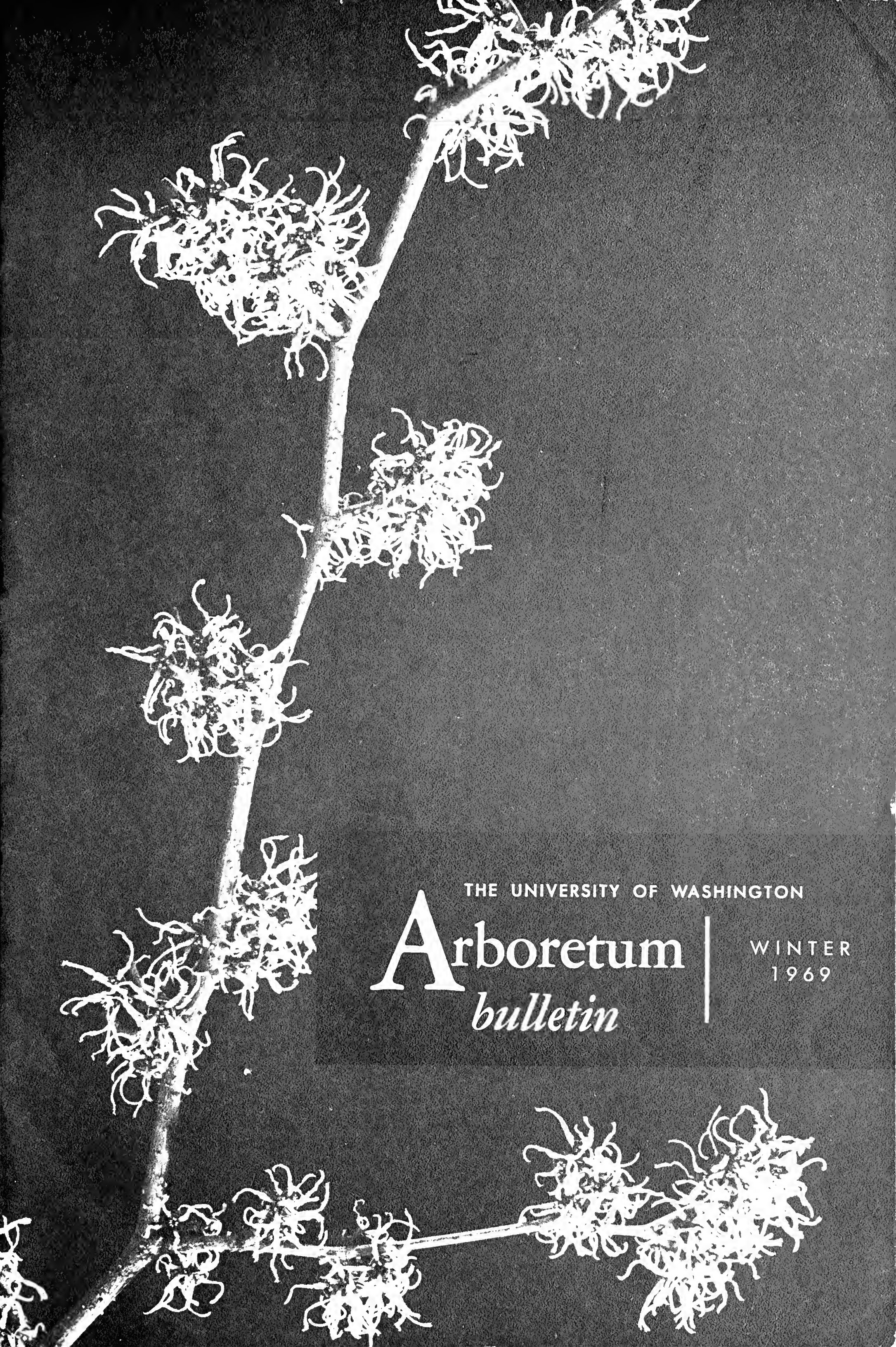

THE UNIVERSITY OF WASHINGTON

Arboretum bulletin

WINTER
1969

PRESIDENT'S MESSAGE

The Holiday Season is always a happy time, meaningful for families and a special time for renewing friendships and a time to reflect on our blessings. Your officers and Trustees of the Arboretum Foundation join in the spirit of the Holiday Season to recognize and say thank you to the men and the many women in the Foundation who are contributing so much of their time and energy (a labor of love) to make the Arboretum a finer and more complete Arboretum than in previous years. The Arboretum is truly a cultural heritage that becomes increasingly important as each generation passes, and as we enter the generation of the 1970's it is incumbent on all members of the Foundation to help preserve and care for this special place, the University of Washington Arboretum. The year 1970 marks the 35th year of the Arboretum and the Foundation plans to commemorate this anniversary.

My special thanks to the officers and the Trustees who have been loyal and devoted to the Foundation programs.

Robert J. Behnke

THE UNIVERSITY OF WASHINGTON

Arboretum bulletin

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The index to the 1969 Bulletin, Vol. No. XXXII, will be published in the Spring, 1970 issue.

COVER PHOTO:

Hamamelis japonica var. arborea

PHOTO BY: WILLIAM ENG

Plants in the North Cascades National Park

*Reid and Mary Kenady

This past summer we had the opportunity to travel through the new North Cascades National Park, exploring some 200 miles of its trails and learning a bit about its character. Officially, our objective was to inventory and study plant distribution, soil conditions, and landscape features, but we also did it for our own enjoyment. In fact it is inconceivable that we could have accomplished anything of the former without anticipation of the latter. The obligation to travel by foot with bed and board on one's back is not always unmitigated pleasure. There are the usual dangers of the trail—plagues of flies, rain, etc.—to which we added the weight of a small botanical library, notebooks, and excessive photographic equipment, and the commitment to keep our eyes open at all times—a considerable demand. Nevertheless, it is true that there are rewards for this sort of travel, and one of them is a very personal relationship, one could say even intimacy, with the plants of the area.

The information which we proposed to gather was to be used as reference material for developing ecological research projects, and by the Park Service as a source of information to be used in management decisions and park interpretation.

*Program Director, Institute of Forest Products, College of Forest Resources.

Alpine Meadow—Easy Ridge.
Photo by: Reid Kenady.

The Park Service provided transportation for some of our bulkiest equipment and made their aerial photos and other pertinent records available for our use.

The park is divided into two sections and we divided our study accordingly, with a two-week interval between to restock and clean up. Our first reconnaissance began at Stehekin, at the head of Lake Chelan, with our principal camp at Bridge Creek Campground, from which we made several relatively short forays into the wilderness. The second half of our study was based at Whatcom Pass in the northwestern portion of the park.

The North Cascades are fantastically impressive. Standing on a mountain looking down or in a valley looking up—it makes no difference—one is quickly convinced that the country is all vertical. We gained and lost over 30,000 feet of elevation during the summer, and generally we stopped where vegetation stopped, far short of the major peaks. Valley floors lie at between 1500 and 2000 feet above sea level. Ridge tops range from 5,000 feet upwards to summits of 8,000 and 9,000 feet or more.

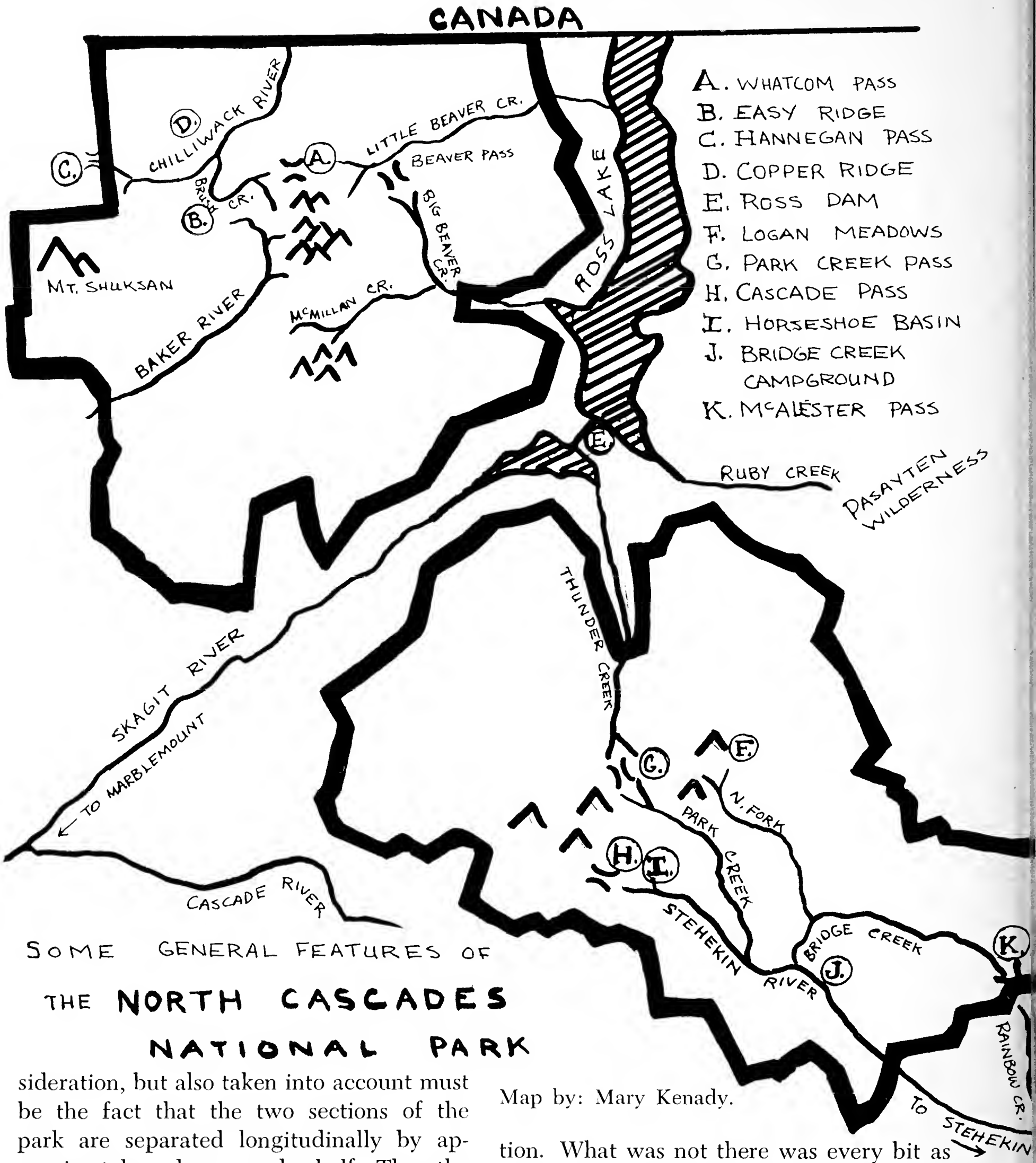
The glaciated valley bottoms are narrow and u-shaped, cut now by a creek or river, and brush-filled. Valley walls are steep, with scree slopes fanning out downwards between islands of timber and brush and exposed bedrock. The soils on these slopes are understandably shallow, generally formed from colluvial material moving gradually down slope.

Openings in the valley walls lead to cirque basins, or the valley inclines upward to end in an extensive meadow and pass area. Most of these basins and protected meadows lie at approximately 4,500-5,000 feet, although the altitude varies considerably with location. The soils here, like the valley slope soils, are shallow except in the rare spots where the terrain is flat or slightly depressed. In such spots the water draining from above can pond and heavy organic soils form from the accumulations of plant matter deposited.

Ridge tops above 5,000 feet are exposed to the battering of all the elements—sun and summer dry spells being at least as devastating as winter storms. Soil does strange things here. One can observe the processes which create it, see where it erodes, washes into relatively stable pockets, blows out and collects against large obstacles, is heaved up by frost action, slumps and sags into patterns covering whole hillsides. Except in the pockets, vegetation has an understandably tentative, cautious look about it.

The places where we stayed longest or that were easiest to get to were the places that received our most vigorous attention. This fact alone may nullify any claims to scientific objectivity we might imply in our descriptions, but it can't be helped. Great field observers must be few and far between. In our case, large gaps in our field notes indicate times of physical stress. For instance, the pages covering the eastern approach to Cascade Pass should have been full of ecstatic jottings: our weather was beautiful, flowers were abundant and bugs were scarce, we were going to a favorite spot by a new approach. Instead we maintained complete silence, and the only record of our coming and going is one totally esoteric photograph. The reasons for this are nevertheless clear enough to us. Going up, it was the 210 pounds of unevenly distributed gear (total weight estimated at the time by the bearer of the heavier portion); coming down it was the pursuit by a pack of 20 stampeding Boy Scouts. Thus are one's soberest judgment and sincerest intentions sometimes hung upon the vagaries of one's emotional stability.

We did, however, collect enough information in our better moments to make some interesting and perhaps useful comparisons. For this purpose, we have chosen a few representative areas to describe briefly here. Elevation is an important con-



SOME GENERAL FEATURES OF

THE NORTH CASCADES NATIONAL PARK

Map by: Mary Kenady.

sideration, but also taken into account must be the fact that the two sections of the park are separated longitudinally by approximately a degree and a half. Thus the Stehekin portion expectably possesses features received from its easterly position which can be compared with the western characteristics of its counterpart. While comparisons are not always helpful, it was often interesting to us to note not only similarities as we traveled, but also the differences in areas of nearly parallel situation. What was not there was every bit as important as what was there, if not so easy to determine.

Valley Bottoms—Stehekin (south) and Chilliwack (north)

Big trees, dim light, padded forest floors, restricted views, and a river with gravel bars and trout pools overhung with cottonwoods and willows characterize the low-

elevation valleys. The east-slope influence encourages diversity in trees, as we found at Bridge Creek Campground, near the Stehekin River. Fourteen species of trees grow within the camping area. In contrast, the Chilliwack expressed its diversity in understory species, with two species, silver firs and hemlocks, dominating the upper story.

Typical of the lowland valleys are the liliaceous plants: queen cup and false Solomon's seal, trillium, twisted stalk, lily-of-the valley, and fairy bells. In all places where the soil is damp and rich in organic matter, we found these plants growing in profusion. Lowland weeds appear in both of these valleys, apparently introduced through horse feed. In this habitat there doesn't seem to be enough light for them to crowd the native species, but this might not be the case in the higher, more open meadows.

Representative species:

Stehekin (Bridge Creek Campground): *Pinus contorta* (lodgepole pine), *Pinus monticola* (white pine), *Pinus ponderosa* (ponderosa pine), *Pseudotsuga menziesii* (Douglas-fir), *Thuja plicata* (western redcedar), *Populus trichocarpa* (black cottonwood), *Acer circinatum* (vine maple), *Acer macrophyllum* (big-leaf maple), *Acer glabrum* (mountain maple), *Cornus stolonifera* (red-osier dogwood), *Pachistima myrsinites* (mountain box), *Adenocaulon bicolor* (pathfinder).

Chilliwack (U.S. Cabin): *Abies amabilis* (silver fir), *Tsuga heterophylla* (western hemlock), *Viburnum pauciflorum* (squashberry), *Sambucus callicarpus* (red elderberry), *Rubus spectabilis* (salmonberry), *Clintonia uniflora* (queen cup), *Tiarella unifoliata* (foam flower), *Tolmeia menziesii* (youth-on-age,) *Dicentra formosa* (bleeding heart), *Rubus pedatus* (trailing rubus), *Dryopteris* spp. (shield fern), *Ribes bracteosum* (stink currant).

Valley Sides—Bridge Creek (south) and Brush Creek (north)

Trails which take the mountain traveler from valley bottoms to ridge tops or passes must, of course, pass through the intervening slopes. Trail builders tend to follow a middle line, going above the brushy valley floor but keeping low enough to ensure that the trail will not be under snow until August of every year. This happy medium goes through what can be characterized as high-bush meadow—a not-so-happy medium for the hiker who must endure its insects, its propensity for being wet even on dry days, its heat and glare on sunny days, and the trail's hazardous habit of vanishing from sight beneath the heavy growth. Fortunately, these unpleasant high-bush meadows are almost always sliced by swaths of timber which appear suddenly, with almost no mark of transitional vegetation, offering the welcome cool air and muted light of a forest canopy.

Representative species:

(open) Bridge Creek: *Ceanothus* spp. (Ceanothus), *Arctostaphylos uva-ursi* (kinnikinnick), *Pachistima myrsinites* (mountain box), *Symphoricarpos albus* (snowberry), *Achillea millefolium* (yarrow), *Antennaria* spp. (pussytoes), *Populus tremuloides* (aspen), *Pteridium aquilinum* (bracken fern).

(open) Brush Creek: *Pachistima myrsinites* (mountain box), *Sorbus sitchensis* (mountain ash), *Alnus sinuata* (sitka alder), *Picea engelmannii* (spruce), *Rubus parviflorus* (thimbleberry), *Rubus spectabilis* (salmonberry), *Pteridium aquilinum* (bracken fern).

(timbered) Bridge Creek: *Pseudotsuga menziesii* (Douglas-fir), *Tsuga heterophylla* (western hemlock), *Thuja plicata* (western redcedar),

Laryx Lyallis and *Tsuga mertensiana* at Park Creek Pass.
Photo by: Reid Kenady.

Pyrola spp. (pyrola), *Vaccinium* spp. (huckleberry).

(timbered) Brush Creek: *Abies amabilis* (silver fir), *Tsuga heterophylla* (western hemlock), *Tsuga mertensiana* (mountain hemlock), *Tiarella unifoliata* (foam flower), *Heuchera micrantha* (alumroot), *Pyrola* spp. (pyrola), *Vaccinium* spp. (huckleberry), *Actaea arguta* (baneberry), *Menziesia ferruginea* (fool's huckleberry).

Cirque Basins—Horseshoe and Logan

A cirque basin is a relatively small hollow in a mountainside, ringed by cliffs and snowfields, and sometimes containing a small lake in its center. The cliffs exclude the worst of climatological onslaughts, but also exclude much sunshine and so create some rather dank, chilly conditions. Those which face north, as the classic Nooksack Cirque, present some fairly effective obstacles to green and growing things, but Horseshoe Basin, near the head of the Stehekin Valley, is south-facing and offers a gentler climate where plants from both lower and higher elevations grow successfully. Logan Meadows do not comprise a typical cirque condition, but the encircling cliffs of Mt. Goode and Mt. Storm King, and the waterfalls and snowfields of Mt. Logan offer a comparable situation for plants.

In general characteristics, the basins combine a Ribes-Rubus-Alnus-Sorbus association reminiscent of lower areas with some of the showy, higher elevation flowers. Where sunlight is restricted by nearby cliffs or the snow lies long, vegetation is displaced downward by as much as a thousand feet or more, meaning that partridge foot, heather and saxifrage can be found. Trees, other than straggling yellow cedars, grow along the sides of the basins. Subalpine fir and mountain hemlock predominate, with a scattering of whitebark pine.

Representative species:

Horseshoe Basin: *Sorbus sitchensis* (mountain ash), *Alnus sinuata* (Sitka alder), *Ribes* spp. currant), *Valeriana sitchensis* (Sitka valerian), *Cryptogramma crispa* (rock brake), *Spiraea densiflora* (alpine spirea), *Chamaecyparis nootkatensis* (yellow cedar), *Abies lasiocarpa* (subalpine fir), *Cirsium edule* (thistle).

Logan Meadows: *Vaccinium* spp. (huckleberry), *Sorbus sitchensis* (mountain ash), *Alnus sinuata* (Sitka alder), *Abies lasiocarpa* (subalpine fir), *Ribes* spp. (currant), *Carex* spp. (sedge), *Spiraea densiflora* (alpine spirea), *Lupinus* spp. (lupine), *Erythronium grandiflorum* (dogtooth violet).

The Passes—Cascade, Park Creek, McAlester and Whatcom

Cascade Pass is by far the smallest of the passes we visited, yet it is the most heavily used and, consequently, the most abused. Nothing can account for its lack of plant species except overuse. The North Cascades Park desperately needs more Cascade Passes—places of accessibility and beauty—so that this one can recover. As an indication of its enormous popularity, three hundred people came to or through the pass on the weekend we spent nearby. It is reasonable to assume that the same thing happened on other fine weekends all summer long.

On the pass grow some venerable old hemlocks and firs; in the circle of their protection survive huckleberries, heather, mountain ash, and a few herbaceous species. The rest of the pass is a flattened greenery laced with trails, the entire effect of which suggests that it has been painted on. Close examination of a green hummock reveals extraordinarily tiny potentillas and bistort, partridge foot spreading diffidently, and a prevalent hardy sedge which seems to be half its normal size. Within ten feet or so of each other, we found individuals of the same species so unlike in size as to make one think the large ones had been reproduced in miniature as an artistic or scientific experiment.

Park Creek Pass is a snow-filled gully, but directly below and on the east side lies a broad expanse of meadow with small

(Continued on Page 102)

Microclimate

Leo J. Fritschen*

The growth and development of plant and animal life depends upon the condition and constituent of their environments. The environment is composed of both the lower layer of atmosphere and the upper layer of the earth. In a given area the environment is in part dependent upon large scale weather patterns such as zones of high and low pressure. The broad scale weather patterns are modified by local variations of the earth's surface, geographical, biological, and man-made factors to form a local climate or microclimate. A microclimate is then the local weather of the zone of the atmosphere in which all plant and animal life exist. It is one of the most important factors which contributes to the well being of man on earth and surpisingly enough, one of the least recognized and generally understood.

In the mountain terrain and associated forestry, microclimate is more important than in any other field because of the large ranges in the climatic elements that exist. If you doubt this, observe the change in variety of plants and animals as you ascend a mountain. Each species has a tolerable range of microclimatic elements and when combined with the soil environment, determine the life zone of the species. Microclimatic data generally are not available, but some local weather data obtained in the vicinity of Seattle will serve to illustrate the range of climatic variables existing over a short distance (Table 1).

Microclimate is composite of many factors some of which are not independent and tend to modify the others. A discussion of microclimate should include a discussion of each of the component parts and their interactions. This may best be accomplished using the energy balance approach.

The earth's surface plays a unique role in partitioning radiant energy into various components, like it does in dividing precipitation into infiltration, run-off, and evaporation. Consequently, there are remarkably rapid changes in climatic variables near it. For example, temperature may change as much as 20°C from the soil surface to a position one meter above. Weather and climate are the result of mixing of the atmosphere (the sea of air above the earth). Without the mixing, weather, as such, would not exist. The sun is the source of energy that causes the mixing of the at-

Table 1. *Climatic variables in the Seattle area*

	Station Locations			
	Sea-Tac Airport	University of Washington	Seattle	Bothell
Average maximum temperature (°F)	59.2	61.0	60.0	60.1
Average minimum temperature (°F)	42.9	44.5	46.4	39.6
Mean temperature (°F)	51.1	52.8	53.2	49.9
Precipitation (inch)	38.94	34.94	34.10	39.28
Snowfall (inch)	14.4	5.8	8.6	10.4
Heating Degree Days	5,251	4,581	4,424	5,540

The climatic variables listed in Table 1 are averages and as such tend to mask out some of the local variation that does exist.

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mosphere. Differential absorption of radiant energy from the sun supplies the mechanism for mixing the air.

The radiant energy being discussed is the type of radiation emitted by an object as the result of its temperature. This radiation is called thermal radiation and all objects having temperatures greater than absolute zero (–273°C) radiate energy.

As the sun's rays penetrate the atmosphere a portion of the energy is reflected from the clouds, a portion is absorbed by the atmosphere, and still another portion is scattered diffusely in all directions. The attenuated radiation that does penetrate the earth's atmosphere, both as direct beam and as scattered diffuse radiation, is disposed of in two ways. A portion of it is reflected from the earth's surface; the remainder is absorbed. The energy which is absorbed heats the surface which in turn reradiates energy of a different wave length in proportion to the fourth power of its absolute temperature. An additional amount of energy is received from the atmosphere as long wave or thermal radiation. The difference between the downward and the upward components of the radiation flux is called net radiation. Net radiation is the amount of energy retained by the surface. This energy is used primarily to heat the surface and the overlying air mass, and to evaporate water. Other energy uses, such as photosynthesis, are neglected because they are comparatimely small. The amount of energy used to heat the soil or the air, and to evaporate water is strongly dependent upon the radiation input and the wind speed which provides the exchange of air and water vapor.

The energy balance of the surface is a dynamic state. A slight change in one parameter will effect the magnitude of the other parameters. An example is the sudden comfort of shade on a hot sunny day resulting from a cloud temporarily obscuring the sun's rays.

The relative magnitude of the various components of the energy balance over a dry and bare soil surface is shown in Figure 1. The numbers in Figure 1 represent energy in terms of calories (cal) per square centimeter (cm^2) per day. Approximately six hundred calories are required to evaporate a layer of water at 1 cm in depth and 1 cm square. Net radiation in Figure 1 amounted to 328 calories. Of this, approximately two-thirds, 225 calories, was used in evaporating water from this bare soil. Sixty-nine calories were used to heat the air, and 34 calories were used to heat the soil. The magnitude of these components would have been different if solar radiation was greater, if the amount of energy reflected was different, or if the atmospheric conditions such as air temperature, wind speed and relative humidity were different.

The potential insolation on various surfaces and mountainous terrain is quite different because of slope and aspect. The

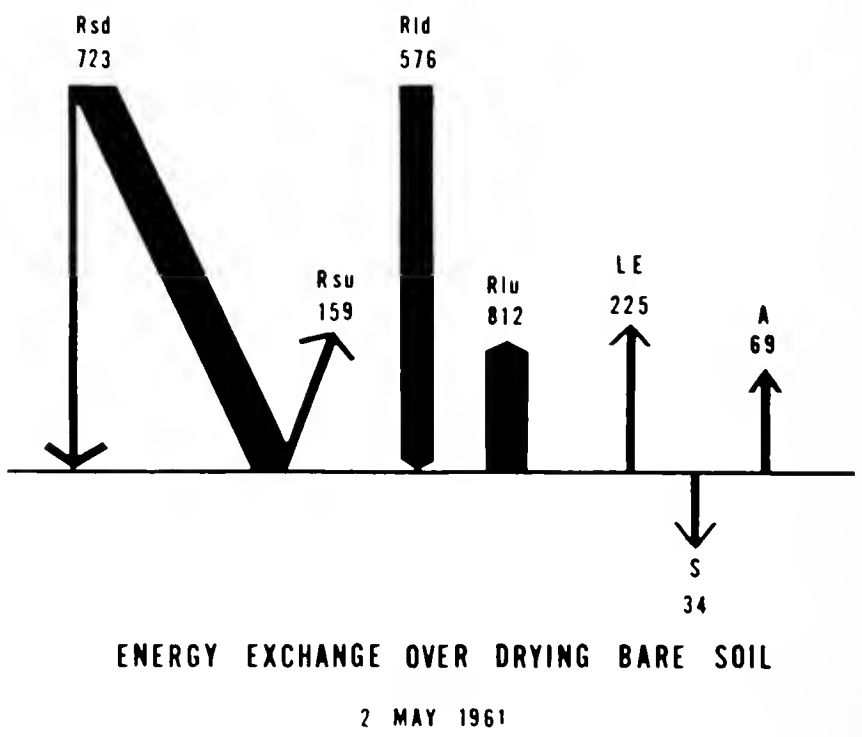

Figure 1.
Components of the energy balance over dry and bare soil. RSD is short wave radiation downward from the sun and the sky; RLD is long wave radiation downward from the sky; RSU is reflected short wave radiation; RLU is long wave radiation emitted by the earth's surface; LE is evaporative flux; S is soil heat flux; and A is sensible heat flux.

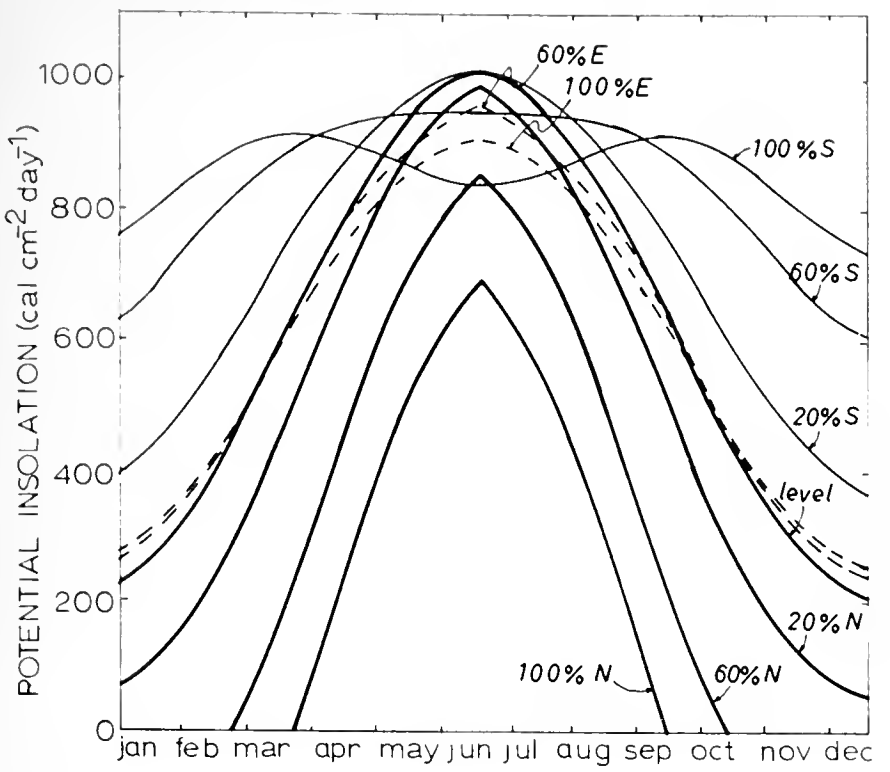

Figure 2.
Potential insolation upon surfaces of different aspect and percent slope at the top of the atmosphere at 48°N latitude. A 45° north facing slope is denoted as 100% N. East or west surfaces are listed as E and south surfaces as S.

radiation plotted in Figure 2 shows the amount of radiation that would be received at the earth's surface if it was not scattered or absorbed by the atmosphere and reflected by clouds. Nevertheless, it can serve to give relative magnitudes of the energy available at the earth's surface. Notice that in excess of 1000 calories per square centimeter are received on a level surface on June 22. This amount drops to 200 calories per square centimeter on December 22 or five times more radiation is received in the summertime as in the wintertime. By contrast, only 700 calories per square centimeter are received on a north-facing 45° slope (100% N) on June 22. The 100% north facing slope is only sunlit between March 21 and September 23. On the other hand, the south facing 45° slope receives about the same amount of energy the year around, between 750 and 900 calories per square centimeter. The energy received by the east and west facing slopes at this latitude is surprisingly enough very similar to the energy received on a horizontal surface. On a yearly basis the east and west facing 45° slopes would receive 97 percent as much radiation as a horizontal surface, while the south facing 45° slope would receive 140 percent and the north facing 45° slope would receive 33 percent of the radiation received by horizontal surface.

The difference in energy available at the surface is further accentuated by the relative reflection of various surfaces. Table 2 shows the reflection coefficients for selected surfaces.

Table 2
Reflection Coefficients for the Short Wave Portion of Electromagnetic Spectrum

Surface	*Percent radiation reflected*
Snow	
Snow, fresh fallen	75-95
Snow, several days old	40-70
Ice, sea	30-40
Sand dunes, dry	35-45
Sand dunes, wet	20-30
Soil, dark	5-15
Soil, moist gray	10-20
Soil, dry clay or gray	20-35
Soil, white sand	25-40
Concrete, dry	17-27
Road, blacktop	5-10
Desert	25-30
Savanna, dry season	25-30
Savanna, wet season	15-20
Chapparal	15-20
Meadows, green	10-20
Forest, deciduous	10-20
Forest, coniferous	5-15
Tundra	15-20
Crops	15-25

The greatest contrast is between the freshly fallen snow and coniferous forest. The former surface reflecting nearly all of the solar radiation while the latter absorbs nearly all of the solar radiation. The difference in the amount of energy absorbed by these different surfaces when combined with the slope and aspect serve to mix the atmosphere and enhance evaporation from a surface, if water is available. Thus in the absence of major weather systems, a bright sunny day would tend to enhance turbulent mixing of the atmosphere, while a cloudy day would tend to reduce mixing.

On a large scale, the differential absorption of radiation by mountainous surfaces promotes rhythmic wind patterns. Dark surfaces tend to absorb more energy than light surfaces. If these surfaces are not wet, then the absorbed energy is used to heat the surface and the air. The warmed air rises and is replaced by air from a cooler surface, thus establishing a convection cell. Convection cells may exist in various sizes from small scale like the contrast between asphalt streets and lawns through large scale like mountain and valley breezes, and land and sea breezes.

Let us consider the circulation known as the mountain-valley wind for an idealized valley. Shortly after sunrise the side slopes of the valley are heated by solar radiation. The warmed air rises up the side slopes and cooler air descending in the center of the valley moves up the slope to replace the warmed air. Later in the morning the upper portion or head of the valley is heated with respect to the lower portion of the valley and air moves up the center portion of the valley to the head of the valley. This air being replaced by descending air in the middle of the valley, resulting in both upslope and up-valley winds. Toward sunset the upper portions of the side slopes are cooled by radiation. The air on the upper portion of the side slope is also cooled, becomes more dense and begins to flow down the side slopes like a river of air. Later in the evening towards midnight, the head of the valley is cool with respect to the floor of the valley and the associated cold air begins to drain down the center portion of the valley. This idealized mountain valley wind may be altered by the orientation of the valley, by the steepness of the slopes, and the vegetative cover. However, the time of onset of the upslope, up-valley winds and downslope, down-valley winds for a given valley are very predictable. The cold drainage wind is dammed like water in a reservoir, by trees, hedges, fences, and road fills forming frost pockets. Thus large microclimate differences are found adjacent to low spots.

The partitioning of the energy at the earth's surface is largely dependent upon the availability of water for evaporation. If the surface is wet, such as a watered bare soil or a vegetation growing on a well watered soil, energy will be used in evaporating water in preference to heating the air and heating the soil. The amount of energy used in the evaporation process is also dependent upon the turbulent mixing which carries the water vapor away from the evaporating surface and can bring additional energy to the evaporating surface through the guise of warm air to support the evaporation process.

A small difference in wind speed can

TABLE 3. THE INFLUENCE OF WIND SPEED UPON EVAPORATION FROM A WET BARE SOIL

Date	*Average Wind Speed*	*Net Radiation*	*Sensible Heat Flux*	*Soil Heat Flux*	*Evaporative Flux*
	$cm\ sec^{-1}$		$cal\ cm^{-2}day^{-1}$		
27 Feb 62	238	207	–6	+38	–167
28 Feb 62	95	215	–122	+5	–108

TABLE 4. THE INFLUENCE OF WIND SPEED UPON EVAPORATION FROM IRRIGATED ALFALFA

Date	*Average Wind Speed*	*Net Radiation*	*Sensible Heat Flux*	*Soil Heat Flux*	*Evaporative Flux*
	$cm\ sec^{-1}$		$cal\ cm^{-2}day^{-1}$		
20 June 63	245	440	147	–13	–574
21 June 63	358	461	274	–4	–731

drastically change the amount of water evaporated from a surface under otherwise similar conditions. Data are presented in Table 3 to illustrate this point.
February 27 and 28 were similar with respect to air temperature, relative humidity, and radiation. The major difference was in wind speed, the average wind being twice as strong on the former day as the latter. A wind speed of 100 cm sec^{-1} is equivalent to 2.2 miles per hour and is barely detectable by most people. This small increase in wind speed caused evaporation from a bare soil surface to increase by 60 calories per square centimeter or 1 mm of water.

If a plant community had been growing on this soil, the increase in evaporation rate would have been larger because the plant community is rougher, aerodynamically speaking, and has more evaporating surfaces exposed to the air flow. Referring to Table 4, an increase in average wind speed from 245 cm sec^{-1} to 358 cm sec^{-1} or roughly from 5 to 7 miles per hour caused the evaporation from this irrigated alfalfa surface to increase from 574 calories per square centimeter (about one centimeter of water) to 731 calories per square centimeter (equivalent to 12 mm of water). The two-mile per hour increase in wind speed resulted in a 20 percent increase in evaporation. Energy to support the larger evaporation rate on the latter day came from the warm air flowing over the cool wet surface. More than half of the energy came from this air source—274 calories per square centimeter.

The presence of vegetation, if watered, causes large amounts of energy to be used in evaporating water, which would have gone into heating the air and the soil if the vegetation were not there. This tends to moderate the climate in the country making it cool and humid as contrasted to a city. Our modern cities have been designed to efficiently conduct all rainfall from paved surfaces through gutters into river channels. The radiant energy which would have been used to evaporate this rainfall is now absorbed by the concrete and asphalt surfaces. This absorbed energy heats these surfaces and the air coming into contact with them, promoting a very dry and hot environment. As a result, cities tend to be warmer than the surrounding countryside. Furthermore, large buildings associated with cities tend to reduce the air circulation; the stagnation of the air tends to enhance the temperature contrast between cities and countryside. As a result a green belt is a very pleasant hideaway from the summer heat of the city.

SUMMARY

It is important to consider a microclimate whether selecting a building site or planting a shrub. The wrong exposure and improper building materials could create an undesirable effect. It should be remembered that hill crests are exposed to strong winds, increased cloudiness, and precipitation if high enough. On the other hand, valleys and troughs lack ventilation and sunlight, have colder temperatures, high humidity, and frequent fogs. Site requirements naturally vary with the climatic region. In the Pacific Northwest an exposure midway up the southeast slope provides a site which has desirable temperature, is dry, maybe above the fog, and is well ventilated to reduce the fallout of atmospheric pollutants.

Still more interesting is the rich and wonderfully varied flora of the mountains. Going up the Sierra across the Yosemite Park to the Summit peaks, thirteen thousand feet high, you find as much variety in the vegetation as in the scenery. Change succeeds change with bewildering rapidity, for in a few days you pass through as many climates and floras, ranged one above another, as you would in walking along the lowlands to the Arctic Ocean.

John Muir—Our National Parks (1901)

Winter Classes

The University of Washington College of Forest Resources Arboretum announces its winter schedule of public education courses. Field, lecture, and workshop classes are being offered in all phases of nature appreciation, expression, and management. Registration is by mail (issue checks to University of Washington) through the College of Forest Resources. For additional information, phone 543-2730.

TREES IN WINTER RAIMENT. Mr. Gary Ritchie, ecologist. Identification of deciduous trees through outstanding winter characteristics. Saturdays, 9:30 a.m-12n, Jan. 17-Feb. 14. 5 sessions; $17.

PENCIL, PAINT, AND NATURE SKETCHING. Mrs. Marianne Kenady, artist. Fundamentals of dry and water media, including polymers. Wednesdays, 7-9:30 p.m., Jan. 7-Feb. 4. 5 sessions; $25.

PENCIL, PAINT, AND NATURE SKETCHING. Mrs. Kenady. Advanced principles of drawing and painting. Saturdays, 1-3:30 p.m., Feb. 21-Mar. 21. 5 sessions; $25.

CAPTURING NATURE WITH FILAMENT AND FABRIC. Mrs. Joyce Krell, floriculturist. The use of stitchery-related techniques as a nature art form. 7-9:30 p.m. Section A: Mondays, Jan. 19-Feb. 16, *or* Section B: Wednesdays, Feb. 11-Mar. 11. 5 sessions. $25.

WAYS OF WOOD—*Wood Structure and Identification.* Professor Lawrence Leney, wood scientist. The use of eye, hand lens, and microscope to identify a variety of woods and to understand the strength, beauty, and special qualities of each. Tuesdays, 7-9:30 p.m., Jan. 6-Feb. 3. 5 sessions; $25.

FROM STEM TO STYLE—*Botany Basics.* Mr. John Main, botanist. Fundamental principles of plant structure and growth. Thursdays, 7-9 p.m., Jan.-Feb. 12. 5 sessions; $16.

GARDENING UNDER GLASS—*from Terrarium to Greenhouse.* Mr. James Nishitani, bontanist. Growing plants in a variety of glass-enclosed structures. Thursdays, 7:30-9 p.m., Feb. 19-Mar. 19. 5 sessions; $15.

WINTER PROPAGATION. Mr. Richard van Klavern, Arboretum propagator. Techniques of propagating woody plants. Thursdays, 1-3 p.m. Section A: Jan. 8 & 22 or Section B: Jan. 15 & 29. 2 sessions; $16.

GRAFTING ORNAMENTALS. Mr. van Klavern. How to graft woody plants for the garden. Thursdays, 1-3 p.m. Section A: Feb. 12 & 19 *or* Section B: Feb. 26 & Mar. 5. 2 sessions; $16.

PRUNING ORNAMENTALS. Mr. Chico Narro, Arboretum nursery foreman. Field demonstrations of techniques of pruning trees and shrubs. Saturdays, 10 a.m.-12 n., Mar. 14 & 28. 2 sessions; $5.

Evening lecture series. Six Tuesdays, Feb. 10-Mar. 17. (Campus) Full series $20; single sessions as indicated below.

Feb. 19. 7:30-9 p.m. BACK IN THE BAD OLD DAYS—*Exhuming Paul Bunyan.* A colorful historical discussion of the part played by the forest resource in developing the Northwest. Mr. Kenneth Macdonald, Assistant to the Dean of the College of Forest Resources. $3.

Feb. 17. 7-9 p.m. LET YOUR GARDEN BE YOU. A look at gardens of many styles, purposes, and geographic origins to adapt to personal usage. Mr. Lloyd Thorson, Landscape Architect. $4.

Feb. 24. 7-9 p.m. ON THE BARE FACE OF IT. How to begin to develop a garden on a raw plot of ground. Mr. Thorson. $4.

Mar. 3. 7-9 p.m. DIGGING UP THE PAST. Some introductory considerations in redesigning an unsatisfactory existing garden. Mr. Thorson. $4.

Mar. 10. 7-9 p.m. NO GARDEN IS AN ISLAND. How your garden relates to your

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New or Unusual Plants in the Arboretum

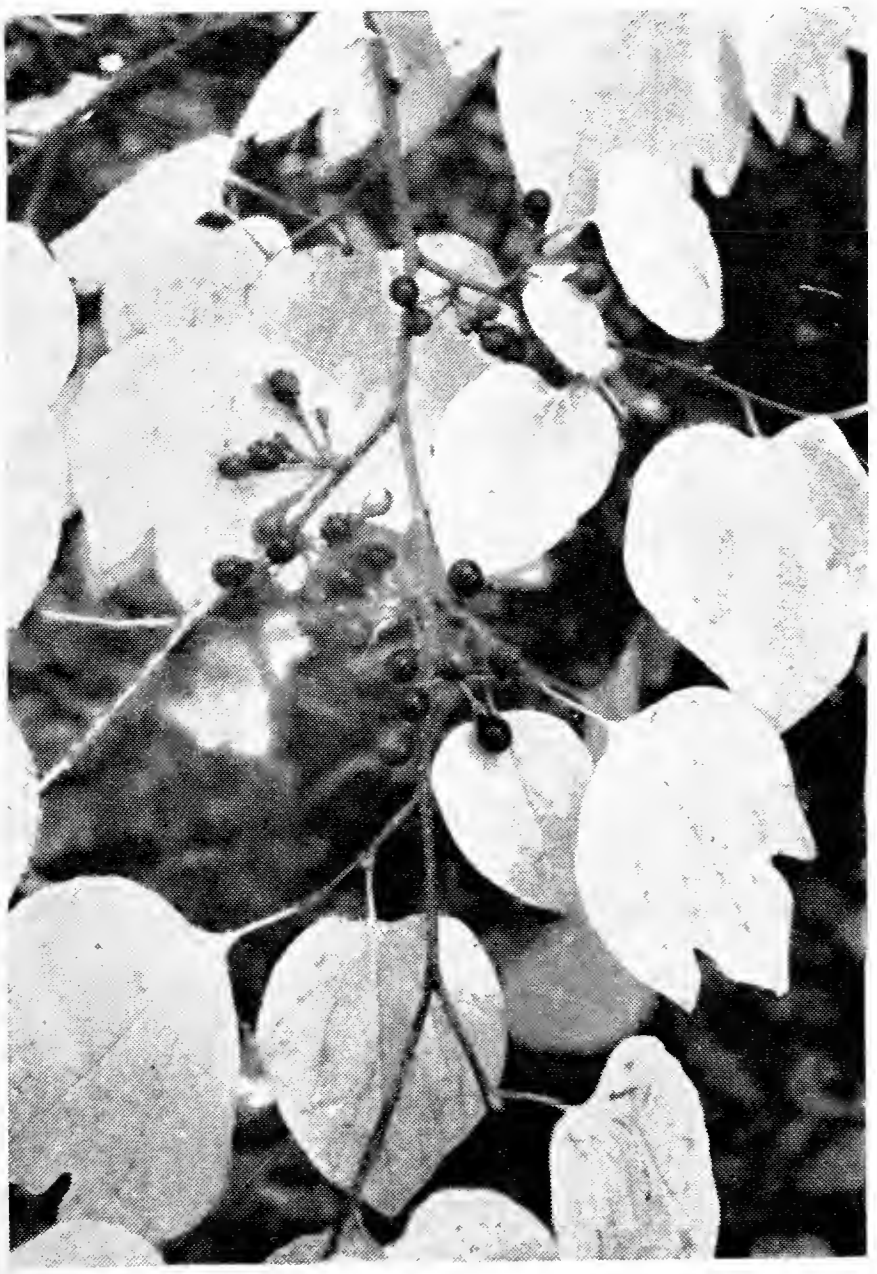
J. A. Witt

XVI *Lindera obtusiloba Bl.*

The Arboretum serves the community as a source of horticultural information, primarily for woody ornamental plants and the staff members whose duties include public contact soon realize that certain types of problems keep recurring in local gardens. One of the most common of these problems is due to the unfortunate attempt to grow large plants in small gardens. All too often we find that a tree or shrub best grown on the estate-sized gardens of several decades ago has been squeezed into a cramped site in an urban garden, to the detriment of both. The unhappy gardener is faced then with the choice of removing a well-loved plant, pruning too severely, or suffering from "Junglitis." This is one of the main reasons that the Arboretum has taken an interest in the introduction of potentially useful small trees and shrubs.

Lindera obtusiloba is one of the most promising of the many small trees or shrubs that we are growing; one that has two seasons of interest, early spring and fall, and a habit that would make it useful to all but the smallest garden. The Arboretum received seeds of this species in 1955 from the Missouri Botanic Garden in St. Louis. The seed had been collected near Toyama, a city on the west coast of Honshu, Japan, near the Japanese Alps. This area is close to the most northerly limits of *L. obtusiloba* in the Japanese archipelago and hence should represent as hardy a strain as can be found.

Lindera obtusiloba in Woodland Garden.
Photo by: J. A. Witt.



The plants raised from these seeds were rather slow growing and remained in the nursery for six years until April, 1961, when four were moved to the Japanese Garden. Three others were planted in Woodland Garden two years later. Both groups have made successful plantings; the average height is now about eight to ten feet tall and slightly less in spread. The soil in both sites is a heavy clay-loam and both receive summer irrigation. Probably they would do as well or even better in sandy loam or almost any other soil so long as it was not waterlogged.

Lindera obtusiloba is a spreading shrub with close brown bark on the older wood and somewhat reddish new shoots. It is intricately branched with a zig-zag pattern not unlike the witchhazels. The alternate leaves are four to six inches long, broadly ovate in outline, usually with rounded central lobe flanked by two smaller lateral lobes. As with its American relative, the sassafras *(Sassafras albidum)* there may be occasional leaves with only one lobe or

more, rarely with none. In the late autumn they turn a brilliant clear golden yellow, often tinged with bronze when the leaf is exposed to the direct sunlight. The three plants in Woodland Garden are especially beautiful at this period since they have a background of dark evergreens and seem to re-radiate the gold autumn sun.

The unisexual flowers appear in early March long before the leaves and at first glance might be confused with the yellow puffs of *Cornus mas.* They, however, are borne in tight clusters (umbels) against the stems and are without the peduncle the *Cornus* has. The umbels are about an inch across, composed of many tiny yellow flowers, which in male plants seem to be chiefly composed of stamens. Appearing as early as they do, they make a pleasing if not striking addition to the array of early spring flowers. Since the plants are dioecious only the female can be expected to produce the clusters of round fruit half an inch in diameter. These are red in September and early October, changing to shining black when finally ripened. The fruit is not especially showy but does make a pleasing contrast with the yellow leaves.

Lindera obtusiloba is a member of the Laurel family, *Lauraceae,* which includes such familiar plants as *Persea americana,* the avacoda; *Umbellularia,* Oregon myrtle; *Laurus nobilis,* the sweet bay or Grecian laurel; and sassafras. It belongs to a genus that, in common with magnolias, witch-hazels and numerous other genera has an interesting discontinuous distribution pattern. Its members are found only in Eastern North America and North Eastern Asia, mainly China, Japan, Korea and Taiwan. There are about 60 species of *Lindera,* two of which are North American, *L. Benzoin,* the spice bush, native from southern Canada to Florida and west to Texas and Kansas, and *I. melissaefolium* found only in the southeastern United States. The Arboretum has a large specimen of the former growing southwest of the magnolia collection. Beside *L. obtusiloba* there are two other Asiatic Linderas in the Arboretu, *L. erythrocarpa,* a slender-leaved species with red fruit, and *L. praecox,* similar but with yellowish to red-brown fruit. Both of these are growing in the south part of the Japanese Garden.

The genus name *Lindera* commemorates a Swedish physician, John Linder, while the specific epithet refers to the blunt lobes of the leaves.

I should like to be able to report that *Lindera obtusiloba* was available in nurseries, but I can find no record of any that does except of one midwestern dealer who offered seed. This is too bad since there could be a wide market for an early spring flowering shrub that also gives superlative fall color and is of a size to fit into the small gardens of today.

Hamamelis japonica var. arborea

B. O. Mulligan

The Japanese witch-hazel, *Hamamelis japonica,* is valued especially for its early flowering habit, in February as a rule, but also, in some individuals at least, for the orange to reddish leaf color produced in October. Thus it can claim to be one of that elite group of shrubs possessing decorative value at two seasons of the year—and perhaps also during the winter months for the attractive structural quality of the branch pattern. The flowers, like most of the other species in the genus, are yellow in color, the petals narrow and twisted; they have a slight but pleasant fragrance, not as pronounced as those of the Chinese witch-hazel, *H. mollis,* but very noticeable when one walks past a bush.

The leaves are more or less obovate, longer than wide, almost smooth when mature, a character which also distinguishes it from its Chinese relative, which is so noticeably hairy on the foliage. Very often a fair crop of the small nut-like fruits is produced in autumn, each containing up to four black seeds which are shot out with

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Growing Acer Palmatum from Cuttings

Dirk Van Klavern

Propagation of maples has always been considered a difficult thing. Some maples such as *Acer platinoides* and *Acer saccharum* can be readily grown from seed while others such as *Acer griseum* produce few fertile seeds which are difficult to germinate. Some maples such as *Acer saccharinum* and *Acer ribrum* produce seeds which will germinate soon after falling to the ground in midsummer, while seed of other species such as *Acer negundo* and *Acer triflorum* develop a hard seed coat which must be treated by scarification and need to be stratified. Most maples available in nurseries today have been grafted.

Only in recent years has the propagation of maples from softwood cuttings become practical. Two new techniques, the use of controlled mist and the availability of polyethylin plastics, have made this possible. The use of controlled mist in softwood cuttings is not new, but its wide-spread use on a large scale is. If polyethylin is used, mist is unnecessary. One maple currently being propagated with great success by softwood cuttings is *Acer palmatum.*

Several factors contribute to the success: the type of cuttings taken, their preparation, the rooting medium, and perhaps most important of all, the proper timing to enable newly rooted plants to be set out in cold frames or lath houses early enough to establish new growth before the dormancy period is encountered in the fall.

Softwood cuttings are made from actively growing wood collected from young plants; in many instances the age of the stock plant determines whether or not the cuttings will root. The younger the plant from which the cutting is taken the better are the chances of success. Tip cuttings are used because they root more readily. They are prepared by trimming to four to six inches and removing basal leaves from that portion of the stem which is to be inserted into the medium. The cutting is wounded on one side through the cambium layer and is then dipped in Hormodin #3 or a full strength solution of liquid Jiffy-Grow, and inserted into the rooting medium. If Hormodin is being used, it is advisable to use one part Captan to three parts powdered Hormodin to prevent damping off. If Captan is not mixed with the Hormodin, cuttings can be dusted with Captan. A good rooting medium is essential. It consists of three parts peat to one part sand or Sponge Rock. Vermiculite is unacceptable because it becomes slimy if too much water is used. The medium should be crumbly damp and about six inches deep. Perhaps the most essential requirement is that it have good drainage. Bottom heat is used. After the properly prepared cuttings are carefully inserted in the medium, the entire bench is covered with polyethylin and sealed with laths. Rooting normally occurs within three to five weeks. Experimentation with lights, fluorescent, red and Gro-lux, has indicated no great difference or advantage in rooting. If plastic is not used, mist is necessary. As soon as adequate roots have formed, plants are transferred to individual pots, hardened off, and sunk in a cold frame with shade overhead. They are left out all winter. A mulch is unnecessary. The important thing is to have plants rooted as early as possible to permit them to get new growth before the dormancy period. Plants which do not continue to grow and establish new growth after being potted, will not break dormancy in the Spring.

Using this method, it is estimated that in the two years this system has been used eighty to ninety percent of the cuttings have rooted and of those which have rooted, sixty percent have grown through the first year after potting.

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*Propagator in Arboretum Greenhouse. See also Vol. XXX, II, p. 65 (Summer, '67).

Propagation of Woody Plants by Seed*

A. J. Fordham

Seed, nature's most common method of plant reproduction, provides a means by which an amateur can propagate many woody plants. Facilities needed are simple and inexpensive. By the use of polyethylene plastic bags, seeds requiring periods of pretreatment can be handled in an almost carefree manner.

Germination is defined as: "The process of the development of a seed into a perfect plant." Before this takes place conditions must be favorable and the seed must be ready to germinate. Many kinds of seed germinate on being provided with conditions such as moisture, air and warmth. Other kinds of sound seed refuse to germinate when given these favorable conditions. Such seeds are not prepared to develop and are termed dormant. This word stems from the Latin word *dormio* which means to slumber or sleep. Until the inhibiting conditions of dormancy are overcome, the seed is prevented from development. Dormancies are protective adaptations which prevent germination at times unfavorable to seeding survival. If these safeguards did not exist and germination occurred during a warm spell in winter, the seedlings would perish in a subsequent cold period. This situation, together with others, is prevented by these natural inhibitors. Nature has furnished these protections to insure continuance of the species.

Immediate Germination

Many wood plant seeds have no inhibiting factors and will germinate shortly after having been sown. Among these are:

Seeds Without Inhibiting Dormancy

Buddleia sp.
Calluna (heather)
Catalpa
Cercidiphyllum (katsura tree)
Clethra (summersweet)
Deutzia
Diervilla
Enkianthus
Erica (heath)
Hypericum (St. John's wort)
Kolkowitzia (beauty bush)
Leucothoe
Oxydendrum arboreum (sourwood)
Phellodendron (cork tree)
Philadelphus (mock orange)
Pieris (andromeda)
Potentilla (cinquefoil)
Rhododendron and Azalea
Spiraea (bridalwreath)
Weigela

After cleaning, seeds in this group are stored dry until sowing time. When handled indoors or in a greenhouse they are best sown in late winter or early spring so that they will germinate and grow with the lengthening days.

Complex Dormancy

Some dormancies are simple, others are complex. Germination of most woody legumes, for example, is retarded by seed coats which are impervious to water. A dormancy of this kind is relatively simple to overcome. To obtain prompt and uniform germination the entry of water becomes necessary. Several procedures will accomplish this. Large type legume seeds, handled in small quantities, can be perforated with a file or sharp knife. Smaller type seeds or large seeds handled in volume can be treated with hot water or sulphuric acid.

Hot water provides a simple, safe and effective means of obtaining rapid germination. Seed is placed in a container; water at about 200 degrees F. is poured over the seed and allowed to cool. Permitting it to remain in the water over night before sowing is advantageous. The amount of water should be about five times the volume of seed. On being removed, the seed must be sown at once. If permitted to dry before sowing, the dormancy can recur. Should this happen, the process would have to be repeated.

The second method is to sow the seed in a can, flat, or other container and pour boiling water over it. In the event that an insufficient number of seeds germinate,

*A reprint with permission from Arnold Arboretum's *Arnoldia*. Mr. Fordham is a propagator and instructor there.

the seedlings which have developed may be removed and the ungerminated balance retreatd with hot water. A second treatment will usually stimulate further germination.

Stratification

Many seeds have internal conditions which inhibit germination. Often this is caused by an immature embryo, which is not ripe although the seed appears mature. Exposure to a period of cold overcomes this dormancy. In nature, such seed would germinate in the spring after being provided with cold by the winter. A period of artificial cold works equally well. Stratification is the term commonly used to define this procedure. This word is derived from the practice of placing seed between layers, or strata, of medium for storage or pretreatment. It is now interpreted as any process used to facilitate the germination of dormant seeds which require pretreatment by time and temperature. This cold stratification is accomplished by placing the seed in a refrigerator at about 40 degrees F. for the required time. Forty degrees is a recommended temperature, but this has latitude. Within reason, whatever temperature the household refrigerator is set for should be effective. Freezing is unnecessary and seed should not be placed in the freezing unit. The container for these seeds should be a polyethylene plastic bag.

Polyethylene has the property of allowing air to pass through it, but is vaporproof. A medium composed of one-half sand and one-half peat moss is suitable. This is mixed together and dampened. Dampened is stressed as it must be moist but not wet. In proportion, the medium should be two or three times the volume of the seed. Advantages in keeping the bulk small will be obvious at sowing time as the entire content of the bag is sown. Twisting the top of the bag and binding it with a rubber band makes it vapor proof for the period of cold stratification. If properly sealed it can be left until time for sowing, be this a month or a year. The following list shows some plants whose seeds respond to this type of stratification, together with recommended periods of time:

Seeds to be Stratified

	Approximate stratification time in months
Abies sp. (fir)	3
Acer sp. (maple) most kinds	3
Aesculus sp. (horsechestnut)	4
Berberis sp. (barberry)	2
Betula sp. (birch)	2
Campsis (trumpet creeper)	2
Carpinus sp. (hornbeam)	4
Carya sp. (hickory)	4
Cedrus sp. (true cedar)	2
Celastrus (bittersweet)	3
Chamaecyparis sp. (false cypress)	2
Clematis sp. (virgin's bower)	2
Cornus florida (flowering dogwood)	3
Cornus kousa (Japanese dogwood)	3
Fagus sp. (beech)	3
Fraxinus sp. (ash)	3
Ligustrum sp. (privet)	3
Liquidambar sp. (sweetgum)	3
Magnolia sp.	3
Malus sp. (apple)	2
Nyssa sp. (tupelo)	3
Picea sp. (spruce) most species	3
Pine (most species)	3
Prunus sp. (cherries, etc.)	3
Pseudolarix (golden larch)	1
Pyrus sp. (pear)	3
Ribes sp. (currant and gooseberry)	3
Sorbus sp. (mountain ash) most kinds	3
Syringa sp. (lilac)	2
Thuja sp. (arborvitae)	2
Tsuga sp. (hemlock)	3
Vitis sp. (grape)	3

These recommendations cover most species in the genera listed. In the maples and mountain ashes, for example, there are some exceptions that will not respond to this treatment. Many of the conifers will germinate when sown without pretreatment, but do so erratically. Cold stratification tends to stabilize this condition and provide a uniform stand of seedlings. This can be important as many conifer seedlings are susceptible to damping-off diseases. When induced to germinate quickly and in unison, they can be potted or boxed in a matter of days. By quickly separating them the spread of these diseases is minimized.

Double Dormancy

Still other seeds have conditions of double dormancy. They require warm, fluctuating temperatures followed by a cold period to be prepared for germination. Dormancies of this kind are caused by reasons such as hard seed coats and immature embryos. The endosperm (food storage tissue) can also be responsible for this. Due to the length of time required for germination, they are called two-year seed.

In nature, after being shed in autumn, such seed would go through the first winter without benefit from the cold because water had not penetrated the seed coat. Through the following summer the seed coat decomposes and permits the entry of water. Consequently, the second winter can provide the cold requirement. With the advent of favorable conditions in spring, the seed, thus prepared, can germinate. Some plants produced seed in a given seed crop which germinate each year for a period of years. Apparently variations in structure cause some of them to require more seasonal cycles than others to overcome inhibitors. This again is a survival adaptation. Should the flora of an area be destroyed, there would be dormant seed remaining which would germinate and furnish replacements. Some examples of these two-year seeds, together with suggested pretreatment, are as follows:

Seeds with Double Dormancy

	Stratification Time in months Warm	Stratification Time in months Cold
*Chionanthus sp. (ringe tree)	5	3
Cotoneaster sp.	5	3
Cataegus sp. (hawthorn)	5	3
*Davidia (dove tree)	5	3
Halesia (silver bell)	5	3
*Paeonia (tree types)	4	3
Stewartia sp.	7	3
*Virburnum	5	3

*These have a dormancy in the shoot bud after seed germination.

Pretreatment of seeds in this group must be done in two stages. They are mixed with medium and placed in polyethylene plastic bags as previously described. For warm stratification they should be provided with a location where the temperature will fluctuate. In some controlled experiments temperatures varying between 68 degrees at night and 86 degrees in the daytime have been used to provide this. Again there is latitude. Bags of seed placed on a greenhouse bench where the temperature ranged between 60 and 100 degrees have produced good results. Any location such as a window sill or similar situation where the day and night temperature varies would be suitable. A place in full sun, however, could result in a build up of high heat which would be detrimental. After the period of warm stratification has been completed, the bag is placed in a refrigerator for its cold requirement. Keeping track of this is easily done by labeling each bag and marking on a calendar the dates they are due to be moved.

Those preceded by an asterisk have a dormancy in the shoot-bud. Toward the end of warm stratification, roots will appear. These signify that the seed is ready for the second or cold stage of stratification. It is well to check this as the time required might vary in different species and with different seed lots. By carefully lifting the bag and looking for roots in the part which faces downward, this is done.

Roots travel down and will be found spreading in the bottom of the bag. When it appears that most of the seeds have produced roots, the bag can be moved to the refrigerator. They are then ready for the second requirement consisting of a 3-month cold treatment at 41 degrees. If this is not done, the root will continue to grow until food stored in the seed is expended. When this happens, the seed will die. The period of cold must be provided to condition the shoot-bud or the seedling will never develop.

Method of Sowing

Containers for sowing seeds in these different categories may be greenhouse flats,

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The Cedars of Lebanon

John R. Leach*

Since the beginning of recorded history, man has had reverence for and worshipped among trees. The groves were his first temples. It seems fitting at Christmas time, so long associated with its symbolic Christmas trees, to write about trees,—the Cedars of Lebanon. In Arabic, they are known as Arz el Rabb, the "Cedars of the Lord." They are also called "Jehovah's Tree," and in the Koran, the "Blessed Tree." According to a legend, the Cross of Jesus was made of cedar. In the Himalayas, cousins of Lebanon's Cedrus *libani*, the Cedrus *deodora*, are known as "Wood of the Gods."

The cedar tree is associated with ancient religious and pagan history. Assyrian King Ashurnasirpal ordered cedar for the beams of his palace. The roofs of the Temple of Diana at Ephesus and the Temple of Solomon at Jerusalem were built of it. King Solomon put up the cash to meet the payroll, furnished the wheat and oil to feed the workers in the woods, quarries and at the temple site in Jerusalem, and procured the services of Hiram-a-Bif of Tyre, in whose domain the cedars grew, to furnish the timber and be the architect of the temple (I Kings 5:5-18). An archeologist states that a cedar beam found in the runis of the Temple at Nineveh, on being burned, retained its fragrance after being buried 2500 years.

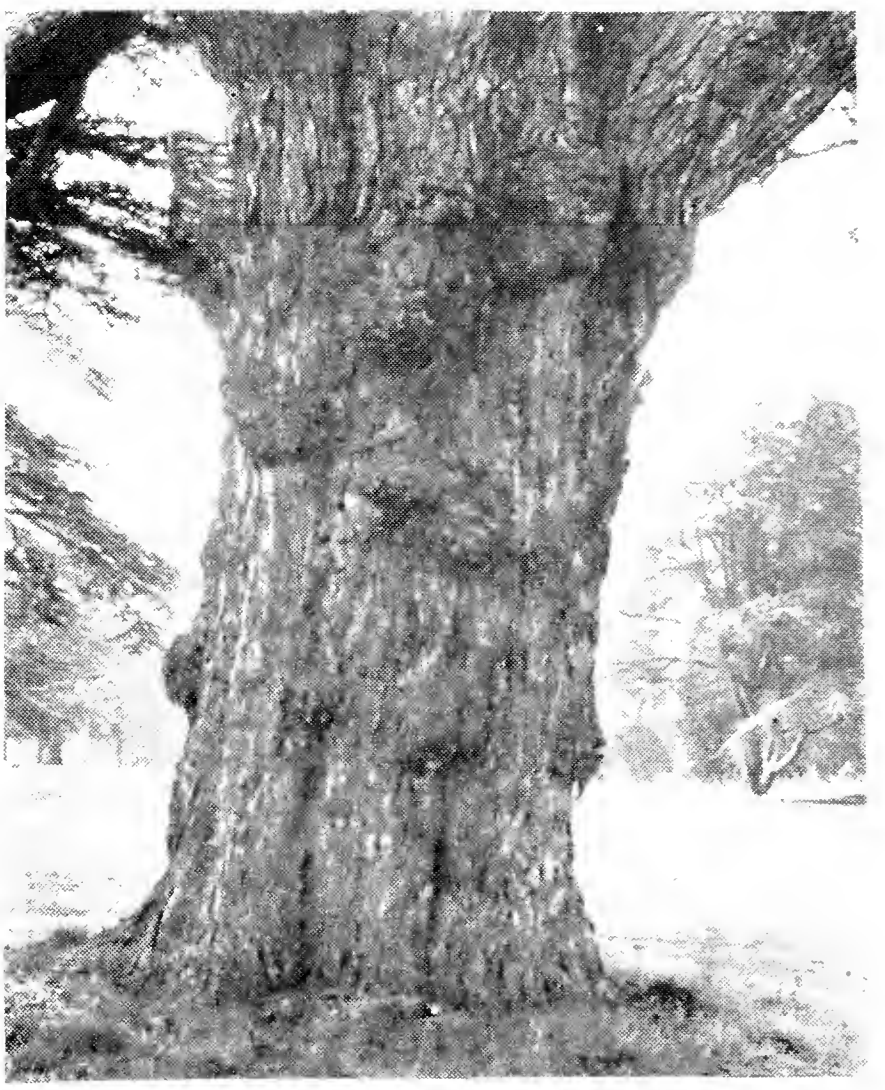
Roman physicians recommended cedar bark and resin for a variety of ailments, and every drug store has oil of cedar for sale today.

Hundreds of centuries of trade took a great toll from the cedars. The oldest were felled first, and gradually the forests became only isolated woods, then lessened to groves; others disappeared entirely.

From England comes the only set of accurate figures I can find concerning the age of the Cedars of Lebanon. They were brought to England in 1642 and are the largest cedars growing anywhere today, —perhaps, due to the care given them, they have grown faster. Nevertheless, the wood is quite poor in comparison with that grown on Mt. Lebanon. In Salisbury, England, in 1874, a tree 36 ft. in circumference was cut down and its rings counted carefully, —it had 236. A tree, 261 years old or less, is growing and measures 25 ft. in girth, 125 ft. tall. Another, in Petworth Park, England, is 125 ft. tall, 49 ft. in girth 5 ft. above the ground. It would seem that about 10,000 years is their age limit.

The Lebanese Government has planted two tracts of 50 hectares each and are in process of planting 500 hectares more. These 600 hectares (about 1500 acres) are a

Trunk of *Cedrus libani*, (Cedar of Lebanon), approx. 5 ft. d.b.h., at Wilton House, Salisbury, England, Sept. 28, 1966.
Photo by: B. O. Mulligan.



*Mr. Leach and his wife are Portland, Oregon octogenarians and long-time members of the Arboretum Foundation.

short distance from the original groves. In the future they will have cedar forests again.

These original groves are on moraines left by glaciers in the Cretaceous period, 55 to 115 million years ago. While they are not as old as the Ginkgo tree, it does date the genus back to the time of the terrible lizards and the beginning of flying birds on earth.

When the present Lebanese government came to power the groves were made a national shrine. And the Cedar of Lebanon was put on the flag, postage stamp, and legal papers.

When Ralph Scroggin, Mayor of Lebanon, Oregon, made a trip to Lebanon, it was as guest of the Lebanese Government. He reported some 6 to 8 inches of snow in the cedars and at the resort on March 1st.

The first to write about cedar trees was a Frenchman named Pierre Belon, who, in 1550, climbed Mt. Lebanon, where is located the Maronite Monastery of the Virgin Mary, which is still in the cedar grove. There today, Masses are still held under a big cedar tree. The Bible mentions the Cedars at least sixteen times. They have always been associated with religion.

Cedrus libani grows either upright with a single trunk or spreading multiple trunks. Usually it has a wide crown and long horizontal limbs which often form a greater spread than the tree is tall. It is monoecious (has both sexes on same tree), with dark green leaves 1 to 1½ inches long at all seasons of the year (evergreen). The cones are graceful and plump, 3 to 4 inches tall and nearly flat on top. They grow upright on the limbs and require two years to mature, so there are cones at all times. The staminate, or polinator flowers are cylindrical catkins ½ inch thick and 1½ to 2 inches tall, also standing upright on limbs. Some years they number in millions and are very beautiful. The female flower is faint purple and is on a stem about ½ inch tall, also standing upright, barely visible from the ground. The bark is as rough as that of Douglas fir.

There are two other true cedars: *Cedrus atlantica* and *Cedrus deodora,* both hardier than *Cedrus libani,* and a number of varieties. *Cedrus libani* grown in large numbers in Turkey and Armenia and has been planted over a large part of the world. Most of ours come from that source. The Arnold Arboretum procured seeds and distributed seedlings.

I am concerned with the small groves of Lebanon cedar that grow on 10,200 ft. Mt. Lebanon in northern Lebanon, about 100 miles from Beirut (Beyrouth). There are about 400 of these trees, large and small, only about ten big, old trees, in groves in Kadisha Valley at an elevation of 6,200 feet. They grow on both sides of a mountain stream, all within 200 yards of the water, and are the only remaining trees from a vast forest.

Our Portland Hoyt Arboretum has 35 trees growing. They are 32 years old, 40 to 60 feet tall. The largest girth measures 4 ft. 6 in.

At our home, here in Sleepy Hollow, we have one that is 83 ft. 7 in. tall, 6 ft. 8 inches in girth, with a spread of 52 feet. It is 35 years old. Size of tree is regulated by soil, moisture, drainage, room, air, sun, climate and length of growing season.

The cedars are also found at the University of Washington Arboretum and the campuses of the University of Oregon and Oregon State University. Our State Capitol grounds at Salem also have some beautiful ones.

About John R. Leach

While trying to find just the right words to describe John Leach, who wrote the preceding article, we came upon his own writings which we think describe him better than we might. We quote:

"While in the Tualatin Academy at Forest Grove earlier, I had a classmate by the name of Lilla Irvin, whom I thought

was about the cutest thing I had ever seen. I had no money to take her any place, but I just could not forget her. I kept track of her all through her college and teaching career. I finally married her twelve years after our first meeting. It was September 13, 1913 with 13 in the wedding party. This was the greatest deal I ever made. She was a farmer's daughter and could cook, keep house, and was also a university graduate and botanist. She later won the National award from the Garden Clubs of America. Our best thirty years were when we gathered botanical speciments for the universities and finished the work done by a former botanist in finding and naming plants. We found seventeen plants new to science; two of them being new genera. This eclipsed the records of any other botanist. Lilla, being the scientific head of the party, got the plants named for her, but I, being the mule skinner, was not entirely forgotten. I got half of the one million burros in the world named for me, as my nickname has always been Jack."

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Winter Classes

(Continued from Page 86)

own immediate and the greater Northwest community. Mr. Thorson. $4.

Mar. 17. 7:30-9 p.m. HAMMOCK HIKING. How to discover the nature books worth knowing or owning. Using the library and making selections for personal ownership. Mrs. Bernice Smith, Forest Resources librarian. $3.

If there is any living thing which might explain to us the mystery beyond this life, it should be seeds. We pour them curiously into the palm, dark as mystery, brown or gray as earth, bright sometimes with scarlet of those beads worked into Buddhist rosaries. We shake them there, gazing, but there is no answer to this knocking on the door. They will not tell where their life has gone, or if it is there, any more than the lips of the dead. *Donald Culross Peattie—Flowering Earth* (1939)

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The Arboretum Bulletin

Vol. XXXII, No. 4 Seattle, Wn. Winter 1969

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SPECIAL NOTICE

To keep membership in the Arboretum Foundation in good standing, dues should be paid during the month payable. Active memberships more than three months in arrears will be dropped and The Bulletin will be discontinued.

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I hereby apply for membership in the Arboretum Foundation and remittance for same is enclosed to cover dues for the next succeeding 12 months.

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All memberships are non-assessable.

Sallie Cole

Maxine Wahlborg*

Three of us from Sallie Cole Unit #83 went to visit Ed Cole one day recently. As we sat in the charming little house at Colewood, looking into lovely woodland through every window, we felt that at any moment Sallie would be coming in from the garden exuding fresh air and enthusiasm.

Chicago born, Sallie spent most of her youth in New York, coming to Seattle in 1913, where she met and married Edward Cole. A daughter, Helen, was born in 1920. Fascinated by materials that grew in their West Seattle home, Sallie began a study of plants that was to last for the rest of her lifetime.

With the death of their only daughter in 1936, the Coles turned with real dedication to landscape gardening in an effort to fill their lives with something new and constructive. An entry from Sallie's diary reads, "Thanksgiving, 1938. We took a ride out to look at acres we had heard about." They saw the five acres, liked them, and arranged to purchase the property, completing the transaction on December 15th. Colewood, planned as a memorial to their daughter, was underway.

In August, the Coles put up a log shelter "so we could get in out of the rain." Then they began a two-year program of clearing undergrowth from the five-acre tangle of woods, making paths and installing roads. "The one path we are still using ends at our neighbor's," said Sallie's husband. Two years later the Coles had a pre-fabricated living room erected and they moved to Colewood. "For a year we lived here with lamps and no plumbing." Landscape architect Noble Hoggson helped them with an over-all plan. Sallie's diary indicates a purchase of "ten hollies, seventy-five hemlocks, ninety cedars, twenty-five pinus contorta,

*Mrs. Karl S. Wahlborg.

and two hundred and fifty native rhododendrons (among other things) for $110.00." Both Sallie and Ed took Arboretum classes offered by John Grant at the University of Washington. Colewood began to take shape as a woodland garden. "Sallie would size up an area, look at it from different angles, then she'd say 'I want a room here,'" her husband recounted. After the space was all or partially cleared, she would create a composition of beauty. Sallie continued her study of landscaping and the Coles were asked to teach an evening class on the subject for the Adult Education Division of the Highline School District. This they continued for over ten years, Sallie emphasizing landscape design, Ed teaching plant care, pruning and fertilizing methods. "Sallie had the knack of keeping people interested," said her husband. "She told her classes, 'If anyone else can do it, you can do it.' We had a good many repeaters."

While Colewood was emerging as a woodland garden of great natural beauty, Sallie's services were sought after. She planned over two hundred gardens in the Seattle area, at least twenty of which are in Normandy Park. She also landscaped five church areas, including Normandy Park United Church of Christ of which the Coles were charter members. Sallie was also an active member of the University of Washington Arboretum Foundation, belonging to Normandy Park Unit #21 since 1951. The fall BULLETIN for 1961 carried an article by Sallie entitled "Fall Color in the Garden." She also served a year on the Arboretum Unit Council Board as Chairman of the Horticultural Committee.

In March 1962, Arboretum Unit #83 was formed and named in Sallie's honor. She frequently attended meetings of our new unit, always creating the impression that she was learning along with the rest of us. Her encouragement was sincere and kind. Knowing Sallie was a live and growing pleasure. She urged us constantly to get to the Arboretum, in all seasons. "There's always an effect to study, always something to learn about plant combinations." Sallie regarded the Arboretum as our very richest source of horticultural information. The lath house held especial interest always.

When we left Ed, we were carrying small branches of *Eleagnus pungens* of which to make cuttings. Sallie seemed not far off.

This is your Arboretum, kept alive by your support

We are pleased to welcome the following new members (August 9 through October 31, 1969): Supporting—Mrs. Harold Helliesen. Sustaining—Mrs. John O. Graybeal. Annual—Mrs. Robert F. Allen, Mrs. Paul J. Avery, Mrs. Alfred Bauer, Mrs. Ellen E. Bowden, Mrs. R. L. Brewster, Mrs. R. Bryan Cairns, Mrs. Oliver E. Cobb, Mrs. George W. Douglas, Mrs. Alan Drake, Charles F. Eherhart, Mrs. Charles Elliott, Mrs. K. G. Fosnes, Mrs. Bruce M. Gascoigne, Mrs. J. I. Goldberg, Mrs. Sidney Gravitz, Mrs. Charles E. Hagensen, Mrs. Arthur S. Harberts, Mrs. Richard H. Hosmer, Mrs. Otto W. Lewis, Mrs. Anthony J. Maurel, Mrs. R. D. McPhaden, Mrs. H. M. Mechelsen, Mrs. R. E. Moore, Mrs. W. F. Norris, Mrs. James R. Oliver, Mrs. Robert K. Pade, Mrs. Drew H. Painter, Mrs. R. S. Peterson, Mrs. Bruno Pierini, Mrs. Warren H. Ploeger, Mrs. Richard Poulsen, Mrs. Kenneth R. Quarles, Mrs. Daniel B. Ray, Mrs. Jack A. Richey, Mrs. Robert K. Robinson, Mrs. W. G. Schipper, Mrs. J. Dugan Smith, Daphne A. Symonds, Roy L. Taylor, Mrs. W. N. Twelves, Mrs. Jack Van Duzor, Mrs. George B. Whatmore, Mrs. Sam Zarkin.

We are also grateful to the following members who have increased their dues to: Contributing—Mrs. Henry Chapin, Mr. & Mrs. James C. Coons, Mrs. Moritz Milburn. Sustaining—Mrs. Howard C. Eddy, Mrs. Alexander Fiskin.

Some of Our Favorites ☆

☆ *Won't You Send Us Yours?*

The Scarlet Oak

EDWARD B. DUNN

This has been a good year for fall color. The regulars, hard maples, sweet gums, sourwoods and others have provided a great display, as usual, but even our own big-leaf maple *(Acer macrophyllum)* has been lighting up the Arboretum and our parks with gold and bronze for weeks.

Good fall color is quite important—to me—in any tree or shrub. All plants give us green in spring and summer, many carry blossoms too, but those that give the extra dividend of flame to brighten the shortening, darkening days, to my way of thinking, serve the greatest measure. All too soon, however, October winds and rain strip the gold coins from birch and cottonwood, swirling them about and pasting them to lawn and pavement to join the red of maple and liquidamber. This is the time, when bare branches appear again on many trees, that one of my favorites is coming into its final flamboyant act. It is late in turning, my scarlet oak *(Quercus coccinea)*, but what a perfect time to come on stage and carry on the show.

There is no nobler or more ancient arboreal lineage than that of the oak. The very name Quercus is a latinization of the Celtic "*Quer*" meaning fine and "*cuez*" for tree and acknowledges an origin in the primeval forests of ancient Gaul. Mythology and history are filled with romantic references to the oak and the genus has served man since his time began in all sorts of practical forms from ships to wine casks.

Q. coccinea (the Latin *coccum* refers to a red dye) is an American native found in mixed growths from Maine to Florida and as far west as Iowa. It accounts for much of the famed "New England" color display of October. The scarlet oak is not the equal of its round-lobed cousin, the white oak, in commercial value although it is a strong and dense timber, but is mainly a thing of beauty and, therefore, a "joy forever"—two hundred years, perhaps.

While the autumn display is the most spectacular of its qualities, this tree is beautiful in all seasons and an almost perfect choice for planting in our Seattle area. This branch structure is open and towering making a sturdy silhouette against the winter sky, while the bark, dark-gray and ridged, seems proper for an oak. A "late-bloomer" in the Pacific Northwest, the leaves are one of the last of the hardwoods to appear in May, but the color and pattern of the yellow-green newness fluttering against the blue sky form a heart-catching beauty that seems the very triumph of spring.

Such an accommodating plant. It withholds its leaves until narcissi, trilliums and other spring bulbs have bloomed, provides a light and high shade for rhododendrons and other sun-shy plants during the growing season, then turns on the most brilliant dress for fall. Scarlet is its name and nothing can equal the clear, bright pigments of its sharply pointed leaves. They seem to contain so many shades of red, yellow, orange and often retain a tinge of green as if resisting such a glorious demise. I know of no more satisfactory and satisfying tree. Clean and neat and free of most pests. Of course, the leaves do drop but they do not persist and hang all winter as on the pin oak and they make the best kind of mold and compost. So many of the good hardwoods require a deep rich soil but *coccinea* seems to like our local gravel and, while it does have a fibrous root system, the roots seldom disturb the surface.

You will find a particularly handsome grouping of scarlet oaks at the parking lot hard by the "Y" that leads out of the Arboretum to that abomination of concrete. Go

and see them at any time. They are always worthwhile but especially in May and November.

I should like to see *Quercus coccinea* used much more in street planting and in private gardens where they can be seen from the roads. If we would all plant more of these now, think how much more beautiful Seattle would be in years to come.

Edward B. Dunn

Camellia Sasanqua Briar Rose

Helen Moodie

The first week in October always finds one of my favorites blooming, Camellia sasanqua Briar Rose. The pale pink single flowers with their bright yellow stamens are usually about 3 inches in width and in nice proportion to the small shiny green serrated leaves. The plant has a quiet air of simplicity and restraint in contrast to some of the more flamboyant japonicas. This year it surprised me with its first opened flower on September 15. The blooms look so fragile and delicate they don't seem able to withstand fall winds and early frosts. Though I would give it a protected spot in the garden, the unopened buds are able to take freezing weather and remain undamaged. If the weather is at all favorable there will still be blooms at Christmastime.

I wish I could say the plant came from the garden of a dear friend or was purchased at an Arboretum sale but it was a happy impulse from a local nursery while shopping for a living Christmas tree about nine years ago. It is one of the few plants in my garden which has remained where it was originally planted, probably because it was a happy location for both of us.

Other than pruning when it seems to become too vigorous in its upright growth, it has received very little attention in the way of garden maintenance. It is fertilized once a year in the spring when I do the rhododendrons. It has its home against an old gray stump in a warm area of the garden near the house where we can see and enjoy it every day. I would advise against planting it near trees or shrubs which color in the fall in the yellow or orange tones. A tree which turns a deep scarlet, however, might be a lovely foil for its blooms.

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Unit Conversation

In answer to expressed needs of our members, the Arboretum Foundation Unit Council is initiating three new educational programs. Already under way is the long awaited Rhododendron Study Group, which meets the first Monday morning of each month. This group will limit itself to members of units.

The following activities however, will be available to all Foundation members: Beginning on the fourth Wednesday of January at 10 a.m. and continuing monthly throughout the year, a nucleus of Arboretum Explorers will gather in the parking lot near the offices to visit areas of interest within the Arboretum. Any Foundation member is welcome to join them at any time.

Also open to all Foundation members, the first class of a series will be "A Gardener's Botany." Mrs. Joseph Witt will be the lecturer. Subjects will include: ecology, plant anatomy, botanical nomenclature, and the use of botanical keys.

Time: 1 p.m. Tuesday, February 25 and March 3, 10, 17, 24, & 31.

Place: The Fireplace Room, Sand Point Community Methodist Church at 4710 N.E. 70th, Seattle.

Fee: $7.50.

To register send $7.50 and your name to the Arboretum Foundation Office, c/o University of Washington Arboretum, Seattle, 98105.

PLANT SALE

Chairman Mrs. Gordon Logan and her department chairmen are hard at work preparing for the Annual Foundation Plant Sale to be held April 30 and May 1, 1970. If you would like to help make the plant sale a success, here are a few things to *do* and a few things to *think* about: Grow cherry-tomato plants, bedding plants, house plants, geraniums, fuschias. *Make* garden art objects such as frogs, turtles, mushrooms, etc. from cement or plastic, sandcastings for fences or walls, wooden or cement planters, bird houses or feeders, bird baths, sundials. *Think about* your neighbors, friends and your own yard for donations of both indoor and outdoor plants. *Think about* volunteering for plant sale jobs. Your offer to help will be welcomed by Mrs. Gordon Logan, AD 2-1313.

At the last membership meeting of the Unit Council, Benjamin Woo, Seattle architect and amateur mycologist, spoke on the subject of "Mushrooms and other Fungi." "Oft-Told Mushroom Recipes," a beautifully illustrated book filled with mouth-watering recipes using mushrooms found in the Pacific Northwest, can be purchased through the Arboretum Foundation office. It would be a thoughtful gift for hostess, birthdays, Christmas, or other occasions. The price is $4.95. If mailed, please add 25 cents for postage and handling. Order by phoning EA 5-4510.

Unit 29 has been the early bird in submitting their yearbook. The attractive cover contains an outline of *quercus garryana*, Pacific post oak, and in the center of the outline, protected between sheets of plastic, is a real leaf of *quercus glauca*, an evergreen Japanese species oak. Three young trees were presented to the Arboretum in December, 1937, by Mrs. O. B. Thorgrimson. One tree is located about 60 feet southwest of the north gate to the Arboretum. It is worth a visit on your next trip to the Arboretum. Unit 29 is a dedicated study group and their study of trees includes beauty and bonuses of bark, pruning, field identification, pines and even a sketching session.

Mary Ellen Russell of Unit 32 attended a series of lectures on environmental planning which were coordinated by Reid Kenady at the University of Washington.

She was so impressed with the discussions that she is sharing the valuable knowledge with her fellow unit members by planning the year's program on factors which effect environment: the geology of Washington; soils of Western Washington; relation of geology and soil to land use; microclimates in our gardens; plant growth; shrubs for an urban garden; and ecology of plants and man.

Propagation of Woody Plants

(Continued from Page 92)

tin cans with drain holes or any suitable container. Tin cans make very satisfactory containers and the supply in inexhaustible. Size of the can will be determined by the amount of seed to be sown. A small soup can would be adequate for small amounts of seed, while a standard coffee can would accommodate larger quantities. The container is prepared by putting an inch or more of broken flower pots, stone, or some such coarse material in the bottom. Sphagnum moss, leaves or such is put over this to prevent the soil from filling the spaces and blocking drainage. Drainage is very essential. Loose-textured potting soil is added, firmed and leveled to fill the can within an inch of the top. A topping of milled or screened sphagnum moss about one-half inch deep, completes preparation for the sowing of fine seeds, such as rhododendron, spiraea and mountain-laurel.

The container is now placed in a vessel with water deep enough to be above the material used for drainage. Capillary action will conduct water upward, wetting the contents. It is well to do this a day in advance of sowing as sphagnum moss wets slowly. Fine seed is sifted over the layer of sphagnum and is left uncovered. Crevices in the uneven surface catch and hold the seed in place. Judgment must be used in sowing as it is a common error to sow too quickly. Larger-type non-dormant seed is distributed over the surface and covered with sphagnum. The rule of thumb recommendation being to cover two or three times as deep as the seed diameter. A favorable time for sowing seed which has no dormancy is later winter or early spring so it will germinate and grow with the lengthening days.

In sowing seed which has been stratified by the plastic bag method, the entire contents is sown and topped with about one-quarter inch of sphagnum. Again this is planned so that one-half inch of space remains at the top when the job is finished. This half inch of space provides for watering.

Completed containers are now placed in polyethylene bags, closed at the top or inverted and tucked underneath. Water should not be needed until the seed has germinated and the bag removed, but it is well to check this occasionally. After germination, the plastic cover must be removed as the seedlings become too succulent when grown in this close atmosphere. Rather than remove this at once, it must be removed in stages for lengthening periods each day, for several days, to harden off the seedlings. They are now ready for the care required in good management of seedlings.

It is not customary to raise hybrids or varieties from seed unless it is known what their performance will be. Usually they do not provide plants with characteristics similar to the parent. Those which are grown because of deviations from normal, such as weeping forms or those with unusual fruit or flower color, often reproduce a percentage of offspring true to type. Examples would be Sargent's weeping hemlock and the pink-flowered mountain laurel which are reputed to come about 90% true from seed. However, many years would elapse before they were ready for segregation. When raising mountain-laurel in commercial work, it would be of advantage to gather seed from only the deepest colored specimens. Premium prices would be justified at time of sale for those with superior flower color.

Plants of the North Cascades

(Continued from Page 80)

ponds in the depressions, fir and hemlock clumps on the high spots. McAlester Pass is also broad and boggy. Whatcom Pass is smaller in size and drops toward the west in a series of benches containing small pools or bogs. Large passes such as these afford an opportunity for different communities of plants to exist. Quite diverse plants can be found along the streams, in standing water, and on the rocky slopes; all of which are part of the pass meadows.

Representative species:

(all passes): *Tsuga mertensiana* (mountain hemlock), *Abies lasiocarpa* (subalpine fir), *Vaccinium deliciosum* (huckleberry), *Phyllodoce empetriformis* (red heather), *Cassiope mertensiana* (white heather), *Rhododendron albiflorum* (Cascades azalea), *Arnica latifolia* (broadleaf arnica), *Valeriana sitchensis* (Sitka valerian), *Erigeron salsuginosus* (mountain daisy), *Potentilla flabellifolia* (cinquefoil), *Kalmia polifolia* (laurel), *Petasites frigidus* (alpine coltsfoot), *Parnassia fimbriata* (grass-of-Parnassus), *Caltha leptosepala* (marsh marigold), *Mimulus lewisii* (Lewis monkeyflower), *Anemone occidentalis* (western anemone), *Carex nigricans* (sedge), *Larix lyallii* (larch), *Pinus albicaulis* (whitebark pine).

Ridges—Sahale Arm and Easy Ridge

Species which live high on the ridges, at 6,000 feet and more, can do so because they have some trick of survival; they keep their heads down, their leaf surfaces are small. Trees are reduced to layered bushes, branches flattened against each other and trunks contorted. Water seeps across granite slabs, lichens grow in the cracks, mosses creep in from the edges. After the mosses come the white heather, with red heather close behind. Small huckleberry bushes grow wherever a degree or two of encouragement can be coaxed from sheltering rocks or topographical irregularities. The occasional gems to be found blooming in the rocks, such as the little golden fleabane, are all the more welcome for their rarity.

Representative species:

Phyllodoce empetriformis (red heather), *Cassiope mertensiana* (white heather), *Luetkea pectinata* (partridge foot), *Saxifraga tolmiei* (Tolmie saxifrage), *Erigeron aureus* (golden fleabane), *Pedicularis groenlandica* (elephant-head pedicularis), *Vaccinium scoparium* (alpine huckleberry), *Sibbaldia procumbens* (sibbaldia), *Penstemon rupicola* (rock penstemon).

This, in summary, was our plant tour of the North Cascades. We can't claim to have seen everything that was there, nor to have noticed everything that we saw, nor to have correctly named everything we noticed. Some plants we should have found and didn't, or shouldn't have found and did, make us eager to go back. That is the nature of the country anyway; it isn't only the plants that invite one back, but they make a dandy excuse for going.

Hamamelis japonica

(*Continued from Page 87*)

some force when ripe. They should be sown the same year and left outside in a cold frame or in a pot sunk in the ground, but even with this treatment may not germinate until the second spring.

The variety *arborea* was introduced from Japan to Europe by von Siebold in 1862. It is not recorded in the *Flora of Japan* (in English), by J. Ohwi, (1965) and therefore presumably is of garden origin. Certainly it has to be propagated vegetatively to maintain its distinctive characters, which are the tree-like form, as compared with the bushy habit of typical *H. japonica,* the deeper, golden yellow of the petals set in a maroon-red calyx and the slightly later time of flowering. The large specimen growing in the winter garden at the Arboretum was obtained from the Kingsville Nursery, Maryland, in Feb. 1949 and planted out in Nov. 1950 with other forms of the species. Because of its height,—about 15 feet—it should be placed at the back of a border or behind plants of the typical species or some of its modern hybrids. It suffers from no pests or dieases and seldom requires any pruning.

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ARBORETUM CLINIC

Beginning in January, the College of Forest Resources Arboretum will offer a new public service for Seattle home owners and gardeners. This service will be a *Plant Clinic* conducted, at no charge to the public, by Dr. Charles Driver, pathologist; Dr. Robert Gara, entomologist; and members of the Arboretum Staff. The program is being developed in response to an increasing demand for information concerning insect and disease attacks on ornamental plants.

The clinic will be conducted at the Arboretum from 1:30 to 4:30 p.m. on the first and third ~~Tuesday~~ afternoon of each month. Individuals with specific plant problems may bring their questions and plant materials to the Arboretum for discussion and identification, or they may call the Arboretum during clinic hours.

This public service project is being offered on a trial basis and may be altered as the demand for information varies.

PLANT CLINIC SCHEDULE

January 15
February 5
February 19
March 5
March 19
April 2
April 23
May 7
May 21